

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

<b>Applicant(s):</b> Dupuis	<b>Group Art Unit:</b> 2817
<b>Application No.:</b> 10/673,750	<b>Examiner:</b> SHINGLETON, MICHAEL B
<b>Filed:</b> September 29, 2003	<b>RECEIVED</b>
<b>Title:</b> METHOD AND APPARATUS FOR PROTECTING DEVICES IN AN RF POWER AMPLIFIER	<b>CENTRAL FAX CENTER</b>
<b>Attorney Docket No.:</b> SIL.P0066	<b>JUN 29 2005</b>

**SECTION 1.131 DECLARATION OF TIMOTHY J. DUPUIS**

Commissioner for Patents  
PO Box 1450  
Alexandria, VA 22313-1450

I, Timothy J. Dupuis, hereby declare the following:

1. I am the inventor of patent application Serial Number 10/673,750 filed on September 29, 2003, which is a continuation patent application of Serial Number 09/932,817 filed on August 17, 2001.
2. I understand that the Examiner has cited Denning et al. US Patent 6,525,611, which issued on February 25, 2003 and was filed on August 1, 2001.
4. I was in possession of the subject matter of the invention set forth in the patent applications listed in paragraph 1 earlier than the August 1, 2001 filing date of Denning et al. Attached as evidence is a disclosure document (with dates redacted) that is dated before August 1, 2001.
5. From the time prior to August 1, 2001 to the filing date of August 17, 2001 (13 working days), I worked with Bruce A. Johnson, the attorney of record, on the patent application that was

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filed on August 17, 2001 and assigned Serial Number Number 09/932,817. This work during this timeframe included revising and finalizing the patent application.

6. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

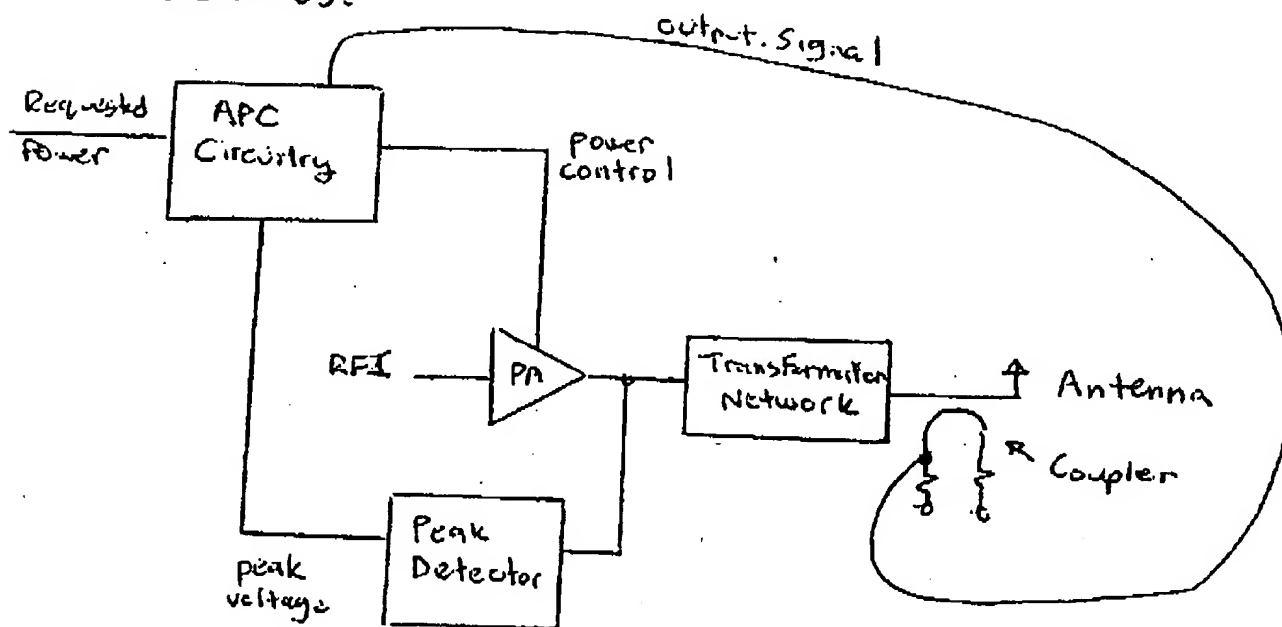
6/14/2005  
Date

  
Timothy J. Dupuis

in a RF ~~power~~ <sup>power</sup> Amplifier.

In a RF power amplifier, load mismatches, temperature extremes and device variations can cause high voltages to be present on the active devices. High voltages can cause breakdown and lead to reliability problems.

The following method of controlling the PA power can be used to protect the devices.



Suzanne Paul.

Tim Durr

In this diagram, the APC circuit will adjust the PA gain until the output-signal power matches the requested power. Normally the output signal power is measured using a coupler.

In the case of a mismatched load the PA gain could become very high in an attempt to deliver the power. This can lead to high voltages and reliability problems.

This invention adds another input to the APC circuitry, which is a measure of the peak voltages at critical nodes.

The APC circuitry will implement the following algorithm, using analog or digital signal processing.

IF (Output Power  $\leq$  Requested Power)

IF (Peak Voltage  $<$  Max Allowed Voltage)

Increase PA Gain

Else

Decrease PA Gain

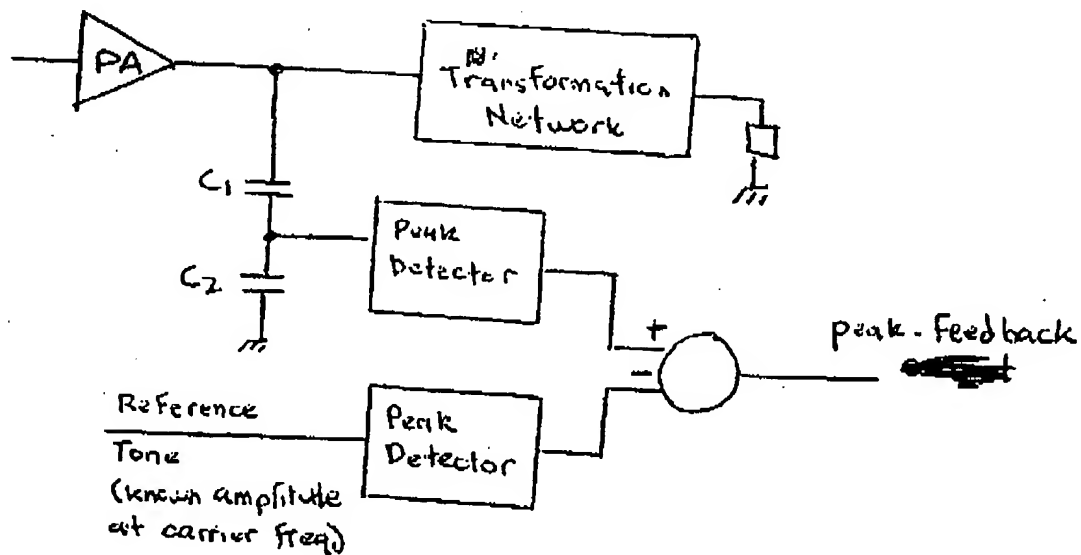
This is normally implemented as a stable negative feedback loop. The 2<sup>nd</sup> condition can be easily implemented as a limiting function.

this algorithm in a controlled manner, will not allow peak voltages to ever get higher than the maximum allowed voltage. This will protect the devices, while limiting the ability of the PA to deliver power to the load.

With this circuitry to PA will be protected from damage, no matter how bad the load is mismatched.

In a CMOS implementation (and others), the peak detect circuitry can be difficult to design and build with any accuracy.

The following circuitry can be used in a non-linear PA to use a simple peak detect circuit.



Susanne Paul

Jim Paul

In this circuit the peak detectors are match so there are no absolute accuracy requirements on them.

The peak Feedback signal is

$$\left[ \frac{C_2}{C_1 + C_2} (\text{peak RFO}) - (\text{peak TONE}) \right]$$

~~The~~ If this signal is positive the peak is too high, otherwise it is OK. The value of the peak can be then used to control the PA gain as described above.